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City.	Indicated case rate per 1,000 inhabitants.	Indicated fatality rate per 100 cases.	Cases reported.	Deaths registered.	Indicated death rate per 1,000 inhabitants.	Population July 1. 1916 (estimated by U. S. Census Bureau).
From 100,000 to 200,000 inhabitants:						
Scranton, Pa	0.116	47.06	17	8	0.054	146,811
Spokane, Wash	.180	11.11	27	3	.020	150,323
Paterson, N. J	.181	20.00	25	5	.036	138,443
Worcester, Mass	.220	16.67	36	6	.037	163,314
Omaha, Nebr	.248	17.07	41	7	.042	165,470
Bridgeport, Conn	.288	31.43	35	11	.090	121,579
Syracuse, N. Y	.289	42.22	45	19	.122	155,624
Springfield, Mass	.302	15.63	32	5	.047	105,942
Tacoma, Wash	.310	8.57	35	3	.027	112,770
New Haven, Conn	.374	21.43	56	12	.080	149,685
Hartford, Conn	.433	15.58	48	7	.063	110,900
Trenton, N. J	.439	6.12	49	3	.027	111,593
Lowell, Mass	.539	21.31	61	13	.115	113,245
New Bedford, Mass	.542	7.81	64	5	.042	118,158
Houston, Tex	.561	47.62	63	30	.267	112,307
Oakland, Cal	.599	6.72	119	8	.040	198,604
Lawrence, Mass	.686	10.14	69	7	.070	100,560
Atlanta, Ga	.750	24.48	143	35	.184	190,558
Camden, N. J	.819	13.79	[1] 87	12	.113	106,233
San Antonio, Tex	.840	17.31	[1] 104	18	.145	123,831
Albany, N. Y	.845	9.09	88	8	.077	104,199
Salt Lake City, Utah	.852	12.00	100	12	.102	117,399
Youngstown, Ohio	.969	25.71	105	27	.249	108,385
Dayton, Ohio	1.014	20.16	129	26	.204	127,224
Grand Rapids, Mich	1.099	14.18	141	20	.156	128,291
Fort Worth, Tex	1.224	14.84	128	19	.182	104,562
Dallas, Tex	1.389	19.65	173	34	.273	124,527
Richmond, Va	1.430	16.52	224	37	.236	156,687
Toledo, Ohio	1.457	15.77	279	44	.230	191,554
Lynn, Mass	1.504	5.19	154	8	.078	102,425
Fall River, Mass	1.714	6.36	220	14	.109	128,366
Reading, Pa	1.801	10.15	197	20	.183	109,381
Nashville, Tenn	2.469	12.11	289	35	.299	117,057
Birmingham, Ala	4.869	9.15	885	81	.446	181,762

[1] The health officer states that cases are known not to be completely reported.

ANOPHELINE MOSQUITOES.

THEIR DISTRIBUTION AND INFECTION UNDER FIELD CONDITIONS.

By M. Bruin Mitzmain, Technical Assistant, United States Public Health Service.

In a series of studies, previously reported by the writer,[1] it was found practicable to establish the period at which infected anophelines made their initial appearance in spring.

The present investigations, undertaken primarily for the purpose of ascertaining the relative distribution of anophelines under field conditions, included also an effort to determine, for a particular locality, the seasonal period at which parasitism of mosquitoes could no longer be demonstrated.

The region selected (Talladega Springs, Ala., about 34° N. latitude) was previously investigated as to its parasite index, the maximum of which was ascertained to be 18.6 per cent among 200 persons. Here, beginning September 17, and extending to November 15, anopheline mosquitoes were collected extensively, special attention being given in this regard to habitations known to harbor malaria in either acute or chronic form.

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[1] *Mitzmain*, Public Health Reports, July 16, 1915, Anopheles as a Winter Carrier of Plasmodium—The Mosquito as a Prophylactic Indicator, pp. 2117-2121.

Relation of A. punctipennis *and* A. quadrimaculatus *to the environments in which they are found.*—It has been previously observed by Carter[1] that *A. punctipennis* is not found commonly in human habitations in the daytime (at least during the summer) and is probably not as important a factor in malaria dissemination as is *A. quadrimaculatus.*

It has been suggested that *A. punctipennis* is of but slight importance because of its remote associations with man; that it is rarely or never found in houses, thus having but limited opportunity to convey infection.

It has been definitely proved that, under experimental conditions, *A. punctipennis* may serve as a vector of malaria; there remains to be determined whether conditions exist in nature in the presence of which this insect may be of epidemiological significance. For this study, a total of 1,377 specimens of two species of *Anopheles*, namely, *A. quadrimaculatus* and *A. punctipennis*, were collected during the period of September 18-November 15, 1916. The mosquitoes were captured with the aid of an electric flashlight by using Griffitt's mosquito collecting device. When a convenient number of specimens were assembled they were transferred into a copper-screened wooden cage made for this purpose.. As many as 200 specimens could be transported simultaneously in this manner and held in the collecting cage until ready for examination. Water was supplied in a gauze-covered cotton pad placed under the cage and the mosquitoes were observed to obtain moisture by piercing the meshes of the pad. These moistened pads also served to cool the air in the container en route, when the cages thus provided were forwarded by post to the New Orleans laboratory, a distance of 400 miles. At least 85 per cent of the specimens arrived in an uninjured condition, suitable for dissecting.

The temperature of the region investigated is represented in the following table:

TABLE 1.—*Temperature records, Talladega Springs, Ala.*

Month.	First week.		Second week.		Third week.		Fourth week.		Fifth week.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1916.	°*C.*	°*C.*	°*C.*	°*C.*	°*C.*	°*C.*	°*C.*	°*C.*	°*C.*	°*C.*
September	34.5	18.0	34.0	13.0	29.5	10.0	32.0	12.0	22.5	7.5
Mean	33.0	19.5	30.5	18.5	26.5	13.0	30.5	15.5	22.0	10.0
October	29.0	9.0	30.5	7.0	30.5	1.5	25.0	−1.5	25.5	8.5
Mean	26.0	7.0	22.5	11.0	23.5	12.0	22.0	3.5	24.0	11.0
November	25.5	4.0	25.5	4.5	18.0	−6.5	18.0	−5.0	15.5	7.0
Mean	24.0	5.5	22.0	8.5	13.0	−2.0	14.5	3.5	12.5	11.0

Monthly rainfall in September, 1916, 5.12 inches; in October, 1916, 0.88 inch; and in November, 1916, 3.58 inches.

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[1] Carter H. R. (1916) Malaria Survey of Impounded Waters, Southern Medical Journal, Vol. IX, No. 8, p. 709.

The following-named environments were daily inspected during this time: Inside of dwellings, under dwellings, privies, vacated buildings, cattle sheds, horse and mule sheds, fowl roosts, and wagon and tool sheds. The following table gives the distribution of the collections made, according to date and place:

TABLE 2.—*Daily record of the Anopheles collected in the region investigated Sept. 18–Nov. 12, 1916.*

Date.	Inside of dwellings.		Under dwellings.		Privies.		Vacated buildings.		Cattle sheds.		Horse and mule sheds.		Fowl roosts.		Wagon and tool sheds.		In covered spring.	Daily totals.		Total.
	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. quadrimaculatus.	A. punctipennis.	A. punctipennis.	A. quadrimaculatus.	
1916.																				
Sept. 18..	3	9					17		59	67			20	4	4			103	80	183
19..		5	1	3	1	6	18		24	30				2	10	12		54	58	112
20..	1	5			9	2	22	1	40	16			7	1				79	25	104
21..				7	2	7	24	5	12	1								38	20	58
22..	5	1			8				10				6					29	1	30
23..					9	5	26		46	26				1	10	5		91	37	128
24..		5			6	9	9	2	37	3								52	19	71
25..		4			10	1	22		38	29					8	3		78	37	115
26..	2	2			5	1	21	3	15	5			2		4			49	11	60
28..	1	5	9	6	6	2	9	1	26	5	3				2			56	19	75
29..		5	1	7			3		3	10		5			3	1		10	28	38
30..		1	1	1			2		8	12	1	1						12	15	27
Oct. 2..			6	1											2	9		8	10	18
3..	1	4		2			1	1		17								2	24	26
4..		1	1	1	2		1	1	12	1								16	4	20
5..	1	2	2					1	29	4	2				5			39	7	46
6..	2	2			5	2	7		6	1						1		20	6	26
7..		2			8	2	16	1	13	3			1					38	8	46
9..					8		17		14	2					2		5	46	2	48
10..	1	1			6	3	6	1	5	1	1		1					20	6	26
12..			11	5	2		3		7									23	5	28
13..			5	2			2		3									10	2	12
14..	5	2	12				3		5	1								25	3	28
16..			10	4	1	1	4		3		4							22	5	27
18..	4	4	5	1	1	1					1							11	6	17
Nov. 12..			1				3		4									8		8
Total..	26	60	65	40	89	42	236	17	419	234	12	6	37	8	50	31	5	939	438	1,377

The table presents the following summary:

	A. punctipennis.	*A. quadrimaculatus.*
Inside of dwellings	26	60
Under dwellings	65	40
Privies	89	42
Vacated buildings	236	17
Cattle sheds	419	234
Horse and mule sheds	12	6
Fowl roosts	37	8
Wagon and tool sheds	50	31

It is indicated that in the three sources of direct human influence, namely, inside dwellings, under dwellings, and in privies, the last produced the greatest number of specimens of *A. punctipennis.* This species comprised less than one-third (30 per cent) of the catch in houses, while under dwellings 62 per cent of the mosquitoes collected proved to be *A. punctipennis.* That the preponderant numbers of *A. punctipennis* infesting houses are found usually in an engorged state resting under the flooring of dwellings, is interesting. It has been observed by service officers, conducting malarial surveys, that although *A. punctipennis* rarely bites while inside a dwelling, it is found to attack persons seated on the porch or gallery of the house, after which these mosquitoes seek rest, presumably under the house in preference to the interior. Mr. Le Prince (in a personal communication) reports as follows: "While the occurrence of engorged *A. punctipennis* in bed rooms is relatively rare it has been observed in the same regions that *A. punctipennis* frequently bites persons resting on the house porch." This is not an unusual habit of an anopheline mosquito. Ross[1] states that *Anopheles* (*Pyretophorus*) *costalis,* a malaria carrier incriminated experimentally in Mauritius, prefers verandas to inner rooms and also bites in the open.

The presence of blood-engorged specimens of *A. punctipennis* in houses and privies justifies the assumption that the source of the blood was probably human, and suggests an active agency in malaria dissemination.

Of the material collected it was feasible to dissect and examine 709 specimens which had been transported from time to time to the New Orleans laboratory and kept three to five days to permit blood-engorged mosquitoes to digest the last blood meal. The first two infected specimens were seen early in the investigation: A specimen of *A. quadrimaculatus,* on September 21 (collected September 18), and a specimen of *A. punctipennis* examined on September 29 (collected September 26). The first appeared with three typical oocysts one-half to three-fourths grown (35μ–45μ in size) on the caudal end of the midgut. The development in these oocysts had not reached the sporoblastic stage and no malarial pigment was observed. One oocyst containing characteristic granules was seen distinctly projecting from the stomach wall. All of the six lobes of the salivary glands of this mosquito were normal in appearance. The second infected mosquito was found September 29, and proved to be a specimen of *A. punctipennis.* In this specimen only a single oocyst was located. It contained a small amount of malarial pigment and appeared to be less than six days in growth—in size nearly 35μ. The salivary glands in this mosquito were likewise uninfected.

An effort was made in this region of Alabama to determine when malaria ceased to exist in a transmissible form before the termination of the active period. For this purpose collections were made from as many houses as possible where known cases of malaria had been observed. Finally, toward the end of October, attention was concentrated on a particular locality, heavily infested with anophelines, and specifically on a plantation, the residents of which were clinically ill of the disease. An interesting situation was presented in the finding of the nine members of this family with malaria, both clinically and microscopically. Thirty-three specimens of anophelines were taken from this house and examined during the period between October 26 and November 21. Some of these were retained under laboratory conditions for an additional two weeks to afford an opportunity for complete parasite development. One infection was noted in a specimen of *A. quadrimaculatus* of this series examined on November 15. A single oocyst apparently of stunted development (size 35–40μ) was observed, but no other evidence of infection was presented. The oocyst was recognized as similar in character to those seen in mosquitoes kept in the laboratory at low temperatures for two months or longer, and which were observed not to develop to maturity during this period.

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[1] Ross, R. (1910), The Prevention of Malaria. Murray, London, p. 635.